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CONTROL OF THE COYOTE IN CALIFORNIA

BY
JOSEPH DIXON

*(Contribution from the Museum of Vertebrate Zoology
of the University of California)*

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CONTROL OF THE COYOTE IN CALIFORNIA

BY JOSEPH DIXON

(Contribution from the Museum of Vertebrate Zoology of the University of California.)

POINTS OF SPECIAL INTEREST

The economic status of the coyote is dependent largely on locality. This animal is not necessarily a "bad citizen." On the sheep range he is a menace; in a squirrel-infested country he is a benefit. If we kill off all the coyotes we must face the problem of ourselves accounting for the thousands of ground squirrels and jack rabbits which the coyote now destroys annually. The coyote stands second among the fur-bearers of California. Certain prime pelts have recently brought up-to-date trappers \$20.00 apiece. In order to bring such a price the pelts must be prime and properly prepared. Control rather than extermination should be our aim in most places. In certain sections actual extermination may be justifiably striven for.

The following methods of control have proved most successful: trapping; poisoning with strychnine in suet pellets; digging out dens containing young.

Coyotes have been successfully fenced out of certain sheep ranges in Mendocino County.

The bounty system is vastly expensive, productive of endless fraud, and does not give general or permanent relief.

Where coyote control is needed, continued, coöperative efforts between the interested counties and the Federal government should be encouraged.

NATURE OF THE COYOTE

The coyote is the most widely distributed as well as the most destructive carnivorous animal now existing in California. Although known by sight to nearly everyone, the coyote is sometimes mistaken for the true gray or timber wolf, a much larger animal believed to be extinct now in this state. Coyotes occur in greater or less numbers in practically every county in the state.

There are three recognized races of the coyote in California. The mountain coyote (*Canis latrans lestes*), often wrongly called "gray wolf," is found in most of northern California, and south along the higher parts of the Sierra Nevada. The valley coyote (*Canis ochropus ochropus*) ranges throughout the foothills and lowlands of California west of the higher Sierra Nevada, and south to the Mexican line. The desert coyote (*Canis ochropus estor*), lives on the Colorado and Mohave deserts, west to Antelope Valley and north into Inyo County. The mountain coyote, well-furred, large and aggressive, is the race which is of most economic importance. The valley and desert coyotes, being more cowardly, come less in conflict with man's interests. Living in the warmer districts of the state their pelts also are of less value.

EXTENT AND NATURE OF DAMAGE

Livestock, poultry and wild game all suffer through depredations of this animal. Typical instances of such depredations are as follows: On the Churchill Ranch near Dorris, Siskiyou County, in the spring of 1916, between 50 and 70 pigs, valued at \$4 each, were destroyed by coyotes. Another rancher in Shasta Valley in the same county had lost \$250 worth of calves, sheep and pigs each year through this animal. These are not extreme cases, and losses of similar magnitude have been sustained by ranchers, sheepmen and poultrymen elsewhere in the state.

In addition to this considerable property loss there is also, at certain times, grave danger of the spread of rabies by coyotes. This disease has been readily transmitted through the bite of a rabid coyote to horses, cows, goats, dogs, cats, and other domestic animals, and in several known cases directly to human beings with fatal results.

VALUE OF THE COYOTE TO THE STATE

Even a coyote has his good points and on a sound business basis these should be fully recognized. The coyote is now, with the exception of the skunk, the most valuable fur-bearer in this state. During the open season of 1917-18 the capture of 1941 coyotes was reported to the State Fish and Game Commission by the licensed trappers of California. A trapper operating in the mountains in the south-eastern part of the state reports the sale of one lot of six coyote skins at \$20 a pelt. Even higher prices than this have been obtained for exceptionally good pelts from other districts. Although the average price received for coyote skins last year was considerably less than \$10, it

will be readily admitted that pelts taken at the proper season, between December 1 and February 15 when the fur is prime, have a very considerable value, and this fact must not be lost sight of in any proposed method of eradication or control.

Due credit must also be given the coyote for destroying rodent pests, particularly ground squirrels. An examination of the stomach contents shows that ground squirrels form a large part of coyotes' diet at certain seasons of the year. The good that they thus do in destroying squirrels, is, of course, counterbalanced in greater or less proportion by their destruction of game birds and mammals. The fact remains that if we kill off all the coyotes, we must face the problem of ourselves accounting for the thousands of ground squirrels which these animals now annually destroy. In certain instances coyotes have actually been afforded protection by ranchers on the ground that they were proving beneficial through the catching of gophers and other rodents when flooded out during the irrigation of alfalfa fields. *A coyote is not necessarily a bad citizen.*

FOOD AND FEEDING HABITS

The coyote is not fastidious about his food. A list of food materials eaten by this animal would be a lengthy one and would include the flesh of nearly all wild and domestic game birds and animals, many insects, lizards and snakes, and numerous varieties of both wild and cultivated fruits. Available food varies greatly with the season of the year and the coyote is quick to adapt himself to changing conditions. The following reports of stomach contents of coyotes from Siskiyou County will give a fair idea of animal materials eaten.

STOMACH CONTENTS OF COYOTES TRAPPED IN SISKIYOU COUNTY

Locality	Date	Sex	Stomach contents
Butte Creek Valley	June 17	Female	Cottontail rabbit
Ash Creek, McCloud River	July 26	Female	6 young chipmunks, 1 ear of domestic sheep, 30 grasshoppers, cowhair
Yreka	September	Female	Digger squirrels
Yreka	Jan. 4	Female	Digger squirrels
Butte Creek Valley	June 2	Male	1 Oregon ground squirrel
Butte Creek Valley	June 8	Male	Oregon ground squirrels
Butte Creek Valley	June 18	Male	Oregon ground squirrels
Butte Creek Valley	June 18	Male	Oregon ground squirrels
Yreka	Jan. 10	Male	Pieces of cowhide and cowhair
Yreka	Jan. 18	Male	1 rabbit

The evidence given in the accompanying table will be seen to be for the most part favorable to the coyote. The evidence now given is against the coyote. Mr. Edward Shock of Hayfork, Trinity County, reports having seen two coyotes run down and catch a young deer. Stomach contents of six coyotes trapped at this locality consisted largely of meat, bones and hair of deer. A male coyote trapped January 31, 1918, by C. O. Fisher, 14 miles south of Douglas, Trinity County, had considerable deer meat and hair in its stomach. A large male coyote was shot while in the act of attacking a flock of sheep by Gabriel Marcelliu on August 7, 1917, at McAfee Meadows, 11,600 feet, in the White Mountains, Mono County. In San Diego County a coyote observed by the author jumped up and snatched ripe fruit from the lower branches of a prune tree. Ripe grapes and watermelons were commonly eaten by coyotes in this locality. Such instances, both favorable to and against the coyote, could be given in numbers, but the important point to remember is that coyotes may be beneficial at one season and harmful at another. However, any fair estimate of the economic value of any wild animal in a given locality must be based on aggregate food material taken for the year. A coyote may be a real asset in a locality where gophers are working in alfalfa fields. The same coyote would be a detriment in a poultry-raising section. The economic status of the coyote may therefore be a question of locality, as well as season.

BREEDING HABITS

The breeding season of the coyote varies considerably with locality. Those living in the low warm valleys breed several weeks earlier than those living in the mountains. Mating has been noted as early as the middle of January and as late as the first of May. February and March represent the main mating season.

The period of gestation in the coyote is nine weeks or 63 days, the same as in the dog.

Normally but one litter of from three to nine young, usually six or seven, are raised each season. Second litters, however, are not unknown. A female coyote, taken by the author in the vicinity of Bakersfield, Kern County, on May 6, 1918, showed plainly that she had nursed young within the previous twenty-four hours, and there was still an abundance of milk in the milk glands. This nursing female contained seven small embryos each less than an inch in length. This specimen (No. 28722, Mns. Vert. Zool.) affords a reasonable basis for the statement that two litters may sometimes be raised in one year.

Breeding dens are carefully selected by the female with a view to effective concealment. The dens are thus usually difficult to locate unless the female is watched or her tracks to the den are followed. The location and construction of the den varies with the topography of the country, as will be seen from the following instances. At Red-rock Valley, Siskiyou County, on June 7, J. O. Miller found a coyote den with six pups about five weeks old. This den was located in the base of a dead fir stub about twenty feet high and four feet in diameter at the ground. The center of the stub was rotten and the nest chamber, three and a half feet in diameter, had evidently been dug out entirely by the parent coyote. The single entrance to the den was through a hole about fifteen inches in diameter at the base of the stub. No nest material other than the dry earth and rotten wood was noted in this den.

At Earlimart, Tulare County, May 21, George Towne found a coyote den on the bare open plain. The distance from the mouth of the burrow to the nest cavity was twenty-six feet. There were several lateral extensions of the burrow and the greatest depth reached was five and a half feet. The top of the nest cavity was less than two feet below the surface of the ground. This cavity, some three feet in diameter, contained five half-grown young.

As soon as young coyotes are able to walk, the mother often moves them from the old den to a new locality, and a mere visit by a person to a den containing small pups will frequently cause the mother to abandon that den and to carry the pups to a new location some distance away. The male coyote may assist some in procuring food for the young, but he apparently does not share in the actual care of them until they are of considerable size and begin to learn to hunt for themselves.

METHODS OF DESTRUCTION

The four most effective methods of destroying coyotes are: (1) trapping; (2) poisoning with strychnine; (3) digging out dens containing young; (4) shooting.

WHICH METHOD TO USE

Trapping is a safe method, saves valuable pelts, when done at the proper season, and can be used by anyone at any time.

Poisoning with strychnine is advisable where coyotes are killing stock, or in other cases where quick results at any cost must be secured. The valuable pelt of the coyote as well as that of other fur bearers is almost sure to be lost by this method.

Digging out dens containing young is a most effective method of reducing the coyote population where conditions permit of finding the dens.

Shooting can be resorted to advantageously where the destruction of some certain "wise" coyote is sought.

The best season to destroy coyotes depends upon the damage being done, whether or not the coyote's pelt is considered of value, and the available food supply. A coyote that is killing stock must be disposed of in the quickest way possible. However, if the coyote is doing but little damage why kill him at a time of year when his hide is worthless? Why not wait until his pelt is prime and will bring a good price, and thus secure adequate return for the small amount of damage the animal may be doing in the meantime?

TRAPPING

The senses of sight and hearing are both very acute in the coyote, yet both of these are inferior to the sense of smell. This highly developed sense of smell combined with unusual cunning is the coyote's chief protection against traps and poison. From the trapper's viewpoint, coyotes may be roughly divided into three classes. First, there is the young unsophisticated coyote, short in experience and long on appetite. Such animals are readily attracted by almost any bait or scent and are easily trapped even by the amateur. The second class is composed of ordinary adults which are usually wary but hungry enough to secure food even at some risk of being caught. The third class consists of wise "educated" coyotes. Most of the killing of sheep, calves, pigs and other domestic stock is done by these old reprobates, which having become "killers," hang around flocks and herds, and secure their meat with little effort. Many such coyotes have lost a toe or foot in a trap at some time or other, and some of them will keep even an experienced trapper working for weeks before they are captured. Of sixteen coyotes taken by a trapper in Scott Valley, Siskiyou County, during the winter of 1917, five showed signs of having been previously caught. Three of the five had one foot entirely gone and two had lost part of a foot.

KIND OF TRAP TO USE

There is a decided preference among experienced coyote trappers for the number 3 "Newhouse" double-spring type of steel trap (see front page). The best trap is the cheapest in the long run, both because there is less danger of the animal escaping, and because of the long service it is capable of giving.

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WHERE TO SET TRAPS

Coyotes usually follow fairly well-defined routes on their various foraging expeditions, and traps should be set, preferably to the windward, near the trails traveled by them. Traps set in the trail itself will often be sprung by cattle, rabbits or ground squirrels. The two most important things to aim at in coyote trapping are to place the "set" where the coyote will find it and to set the traps so they will catch the coyote when he arrives. Take time to learn what trails the coyotes are using before setting traps. A great number of special sets used by professional trappers cannot, for lack of space, be given here. Three of the most widely used and best types of sets are given as follows:

Fig. 2.—Diagram illustrating Open Set. Traps shown in position but not bedded.

Open Set (See Fig. 2).—Select a little open place somewhere near the coyote's line of travel, where the ground is loose and free from stones. Secure a flat square-edged rock weighing about fifteen pounds. Take baling wire and wire together the rings of three steel traps, then *wire* these *securely* to the rock, which latter will serve as a drag and marker when the coyote is caught. If the traps are fastened to anything solid, which will not "give," there is danger of the coyote pulling loose when he plunges about in the trap, unless securely caught. If necessary to chain it to a root or stake, it is advisable to substitute, in the place of two links of the chain, a stout steel coil spring three-fourths of an inch in diameter and four inches long, such as is used in the construction of a common type of bedspring. This affords enough "give" to prevent the coyote pulling out of the trap. Dig a hole deep enough to contain the drag. A prospector's pick is handy for such work. Put the drag in the hole and place the traps about twenty inches distant from the drag so that they will form a letter Y with the drag in the center. Dig a pocket for each trap

just deep enough so that the set trap will be level with the surface when covered with an eighth of an inch of dirt. Cover the drag with the dirt removed in setting the traps. Dig slight trenches for the chains. Set the traps, turn the springs toward the bases of the pans so that the jaws will lie flat, and bed each trap firmly in its pocket. Then cover the springs and chains with dirt. If a trap springs too easily take a bit of fine straw about three-fourths of an inch long and stand it upright like a pillar, under the pan. Fine dry grass or wool plucked from an old sheepskin, placed loosely under the pan will keep pebbles or clods from rolling under it, since these are liable to hinder or prevent the trap from springing. Another good method is to place,

Fig. 3.—Diagram of Trail Set. Traps in position but not bedded.

a sheet of thin paper (orange wrappers are good in dry weather and waxed paper in wet weather) over the spread jaws and pan. Cover the edges of the paper with dirt and then sift dirt through the fingers (to remove clods, sticks and pebbles) over the trap until the paper is covered evenly with about an eighth of an inch of fine dirt. Brush lightly over the trap with a bunch of grass or weeds or with a fresh skunk skin, and then scatter a few dead leaves and grass over the "set" to restore naturalness. The use of both scent and meat bait at the same time is not recommended. Scatter a spoonful of scent in the center of the "set," or, if bait is to be used, scatter a small handful of lard cracklings, or of scorched bacon rinds cut into fine bits, about the traps so as to keep the coyote hunting about until he steps into one of them. Bait should be used sparingly. Coyote trapping is one business where it doesn't pay to advertise too extensively. A jack-rabbit or chicken hung up in a bush over a trap is simply a danger signal to a "wise" coyote.

Trail Set (See Fig. 3).—Wire three traps to a rock drag as described in previous set. Locate a little opening, backed by a rock or bush at the side of the trail. Dig a hole about twelve inches from, and parallel to, the trail and bury the drag so that the top will be

about three inches below the surface. Set the traps directly over the drag and cover carefully with paper and fine dirt. Bait by burying a piece of putrid meat or fish about ten inches beyond the traps. The top of the bait should be just flush with the surface when covered. If fetid bait or scent be used, it should be sprinkled just behind the trap so that the coyote will step into the trap as he steps about sniffing the scent. Disturb the soil and surroundings as little as possible in setting the traps, and when through brush out all surface sign and sprinkle dead leaves over traps and bait. Leave everything looking as natural as possible.

Carcass Set.—The decaying carcass of a horse, cow, sheep or other large animal usually attracts coyotes and affords an excellent place

Fig. 4.—Diagram of Carcass Set for “wise” coyotes. Traps in position but not bedded.

to set traps. Wait until the coyotes become accustomed to visiting the carcass, then select a slight mound or open place *thirty or forty feet* from the carcass and carefully set the traps as described in *Open Set*, using scent instead of bait. A useful variation of this set is to place one trap near the scent and then *carefully* set the other two traps from four to ten feet away (see fig. 4). These outside traps will often catch wise coyotes that circle around hesitating to go near the scent or bait. No amount or kind of scent or bait will draw a “wise” coyote into a poorly set trap.

It is not necessary to wear gloves when setting traps. If coyotes are very shy, set the traps and leave them 48 hours before baiting, since human scent will be gone by that time. Baiting can be accomplished without leaving any trace of human odor by pouring fetid bait or scent from horseback.

In many localities pack rats, kangaroo rats, ground squirrels and other rodents keep springing coyote traps. A few spoonfuls of strychnine coated barley, prepared according to the government formula,¹ if scattered near the traps will clean up these interfering rodents.

¹ Circular letter issued by Bureau of Biological Survey, U. S. Dept. Agric., June, 1917.

DIRECTIONS FOR MAKING FETID BAIT OR SCENT FOR COYOTES

There are numerous formulas for making scent or fetid bait for coyotes. The following method has been used extensively by coöperative state trappers under the directions of Field Foreman J. O. Miller, of the United States Biological Survey, and has been chosen as the method best adapted for general use in California.

1. Take one gallon of well-decayed fat fish which has rotted four or five weeks in a warm place but not in the sun. Add a little water so that the bones can be removed. Pulverize and strain through a fine wire screen. Fat ground squirrels or venison may be used instead of the fish if run through a meat grinder and then allowed to rot for six weeks, during which time the decoction should be stirred occasionally.

2. Take $\frac{1}{32}$ ounce of powdered tongking ("tonquin") musk and dissolve it in four ounces of 95 per cent grain alcohol for ten days. Unless musk is dissolved in alcohol it remains in powdered form and is liable to be lost. If tongking musk is not available, use one ounce of common musk such as is used for perfume, or one ounce dried musk glands of the muskrat.

3. One ounce of triple extract of beaver castor. If this is not available, dissolve one ounce of good gummy beaver castor in four ounces of alcohol.

4. One-half ounce of pulverized asafetida.

5. One quart glycerine, or an equal amount of strained honey.

Mix the dissolved musk, beaver castor and asafetida (2, 3 and 4) with the glycerine (5), which latter helps to prevent evaporation. Then mix thoroughly with the liquid decayed fish or meat (1). Then strain, bottle, and cork the bottles loosely. When freshly bottled the compound tends to blow the cork, but this will cease after a time. This fetid bait or scent keeps well; some made six years ago proved very effective when used the past winter. One ounce of fetid bait is sufficient for four or five settings of traps.

The following scent made from the secretions of the coyote is popular with professional trappers.

Put into a wide-necked bottle the urine, gall and anal tract of a freshly killed coyote. Add water to make four fluid ounces. To this mixture add one ounce of glycerine and one grain of corrosive sublimate. Let the mixture stand for ten days in a warm place, but not in the direct rays of the sun. Then add one-half ounce of powdered asafetida and shake well. The scent is then ready for use.

POISONING

1. Properly used and safeguarded, poisoning with strychnine is a valuable aid in coyote control. .

2. If local or county poison campaigns be inaugurated, the work should be done under the direct supervision of the Predatory-Animal Inspector of the Bureau of Biological Survey, United States Department of Agriculture, or of some other responsible person experienced in such work. Indiscriminate use of strychnine is illegal, and its use by irresponsible parties cannot be too strongly condemned.

3. Poisoning with suet pellets containing 2 grains of strychnine enclosed in a gelatin capsule is the best method for general use. These pellets are deadly, easy to prepare, economical, and convenient to handle. Directions for making the poisoned suet pellets are given herewith.

4. The object of placing the strychnine in the gelatin capsule is to conceal its bitter taste. Enclosing the capsule in suet, bacon, or other grease insures protection from rain or moisture; and the grease covering also assists the coyote in finding the pellets which, being small and tasty, are swallowed whole by the unsuspecting animal.

DIRECTIONS FOR MAKING POISONED SUET PELLETS

Provide:

1. A handful of beef suet which has been run through a meat grinder.

2. A supply of gelatin capsules filled with 2 grains of powdered strychnine sulphate. After being filled, the capsules should be thoroughly wiped or dipped in alcohol to remove any of the bitter strychnine that may have adhered to the outside.

3. A piece of bamboo $\frac{7}{8}$ inch long with a hole about $\frac{1}{2}$ inch in diameter.

4. An old penholder, and a stick which will just slide through the piece of bamboo.

5. A wooden bucket.

6. A supply of waxed paper, such as that used in wrapping candy or butter, cut into sections 3×4 inches.

Crowd the suet into the piece of bamboo until the hole is full. Then with the end of the penholder punch a hole in the suet large enough to hold the 2-grain capsule containing the strychnine. Place the capsule in this hole, then with the larger stick shove the suet plug, containing the capsule, out of the piece of bamboo. Roll the bullet-

shaped capsule between the palms of the hands, rounding the ends and thoroughly covering all parts of the gelatin capsule with the suet. After the suet pellets have been thus smoothed up so as to be watertight they should be placed in a wooden vessel and left uncovered in a safe place for 48 hours by which time the human odor will have vanished. After this they should never be touched by human hands. The pellets should be picked up with forceps and placed on the sheets of waxed paper and then rolled up, cigarette fashion, and the ends of the paper tightly twisted. The wrapped pellets are then packed twenty or forty to a package and, when properly labeled *poison*, are ready for distribution.

To put out the pellets without touching them, take the twisted ends of the waxed paper between the thumbs and forefingers of both hands and unroll the package. Then with a little twist of the wrists the poisoned suet pellets can be flipped out on the ground without being touched.

The poisoned suet pellets can be dropped by a man on horseback without leaving any telltale human scent. They should be dropped at places where coyotes urinate or scratch up the ground, or along trails known to be traveled by them. In putting out poison at a carcass, place the poisoned baits, not in the carcass, but rather drop them 30 or 40 feet distant where they will be regarded with least suspicion. A record of all poisoned baits put out should be kept, so that those not taken by coyotes may be gathered up after being left a reasonable length of time. They should not be strewn about promiscuously, nor should they be left out indefinitely, a constant menace to various other fur-bearing mammals and to dogs.

A safe method for a sheepman to follow is to put out the poisoned suet pellets upon breaking camp, having first tied his dogs to the wagons or pack animals. Then after the poison has been put out, the sheepman, with dogs still in leash, may move to a new site, leaving the coyotes to find the poisoned suet pellets in the camp refuse.

SHOOTING

This method of destruction is of particular value where certain individual coyotes are killing pigs or stealing chickens and their speedy destruction is therefore urgent. Coyotes ordinarily return to such free lunch counters quite regularly and hence they may be waylaid and shot with fair success when once their habits are known. A "30-30" or similar rifle is of service in this connection, since the coyotes are usually keen enough to keep out of the range of a shotgun.

LOCATING DENS

Coyote dens may be best looked for during the months of May and June. To be of value in control campaigns, breeding dens must be located before the young quit them. These may be found by "lining" the tracks of the female, made as she carries food to the young. This is accomplished in a manner similar to that by which bees are lined to a bee tree. The female coyote, however, rarely if ever goes straight to the den, but if she is watched, or her tracks followed for a few days, it will be found that all of the various trails center at the breeding den. A person is therefore often able by encircling a supposed den site to "pick up" tracks made by the female and, by noting the general direction of a number of such radiating trails, determine the approximate location of the breeding den. The success of this method is obviously dependent upon the topography, and upon the nature of the soil, which may make tracking hard or easy.

Having secured the approximate location of the den, the exact site it often revealed by trampled vegetation and numerous footprints of the coyote pups after they have become large enough to play at the entrance to the den.

Dens containing young are sometimes found late in the day and the discoverer, returning the following day, and proceeding to dig out the den, is likely to find to his chagrin that the young have been removed by the mother during his absence. If such dens must be left for any length of time the entrances should be tightly closed with rocks, and a coat or other article of wearing apparel which carries human scent hung on a stick over or near the den to frighten off the returning parent.

OTHER METHODS OF CONTROL

In certain counties in the northwestern part of the state, coyotes have been controlled over considerable areas by the erection of coyote-proof fences. This method has proved successful during the past ten years on the 5600-acre sheep range of J. H. Clarke, six miles southwest of Laytonville, Mendocino County. The Clarke ranch is decidedly hilly, and it is well watered; about one-half of the area is thickly forested. Herding sheep in large flocks is impracticable here on account of the rugged nature of the country. Several types of fences have been tried on the Clarke ranch, the two most satisfactory being a redwood stake fence and a heavy woven wire fence. Materials for

the stake fence, namely redwood posts and split redwood stakes, are close at hand and this type of fence seems to have solved the coyote problem at this particular point.

It consists of split redwood stakes approximately four inches wide, one and one-fourth inches thick and six feet long, driven one foot into the ground at a season when it is wet, and are placed three inches

Fig. 5.—Diagram of coyote-proof redwood stake fence. This type of fence is particularly adapted to rough ground.

apart. A heavy No. 9 galvanized wire is fastened to the eight-foot redwood posts which are set an average distance of thirteen feet apart. Each picket or stake is then lashed, near the top, to the heavy wire by a light No. 13 wire, and two heavily barbed wires fastened to the posts at points three and nine inches, respectively, above the top of the pickets. (See fig. 5.)

The woven wire fence is fifty-two inches high. The top and bottom wires are No. 10, the middle wires No. 12, and the cross-wires No. 13; all are galvanized. The mesh in this fence is *triangular*, and this feature is important. Square mesh fence, especially the welded-joint type, proved unsatisfactory because it would not "give" sufficiently in crossing gullies and sharp ridges to follow the contour of the ground. A barbed wire is fastened all along at the bottom

of the posts, three inches underground. Two other barbed wires, the sharper and more numerous the barbs the better, are fastened to the posts three and nine inches above the top of the woven wire. (See fig. 6.)

The Clarke ranch is cross-fenced into several fields, and where the fence crosses ditches or streams a sluiceway of redwood boards is

Fig. 6.—Diagram of coyote-proof woven wire fence, adapted to regular slopes and even ground.

constructed to carry the water beneath the fence. A wooden gate is hung across the sluiceway, closing the opening beneath the fence. This gate is hinged to swing down hill and thus let the water through. Coyotes are afraid of such swinging gates, but they do sneak inside the fence and kill sheep when they find a place where stakes have been knocked out by a bear or some careless hunter. The fence is therefore watched by the owner, and the presence of a coyote inside soon detected. A good pair of fox hounds keeps any trespassing coyote on the move and soon drives him from cover, to be shot or, sometimes, if hard pressed, to escape over the top of the fence. Steel traps are also used.

The cost of the redwood stake fence, as described above, varied from about \$350 to \$400 per mile. Redwood stakes rot off at the ground in from 25 to 30 years and then have to be resharpened and

redriven. The woven wire fence would cost about the same as the stake fence, and may be expected to last as long with considerably less danger of damage by fire.

Fencing against coyotes is impracticable on the open sheep range in most parts of California, but in certain hilly sections where herding is difficult and where redwood for fencing is near at hand, this method has, as stated above, proved of decided value.

COYOTES VERSUS DOGS

The average ranch dog is worthless as a coyote destroyer. A single dog is at a disadvantage since two or more coyotes may lie in wait for him. However, there are wellknown instances where a brace of wolf hounds or a pack of fox hounds has "cleaned up" the coyotes in the vicinity of ranches. It is a difficult matter to combine the use of traps, strychnine and dogs without disastrous results to the dogs.

THE DANGEROUS BOUNTY SYSTEM

In 1919 twenty-eight counties in California offered bounties on coyotes ranging in amount from one dollar in Mono County to twenty dollars in Sonoma County (see map, fig. 7). A conservative estimate based on the returns of several years, places the average amount paid out for coyote bounties in this state at about \$40,000 per year. Varying widely in the different counties, the bounty system has been subject to frequent change and abuse. A typical county ordinance provides that the affidavit necessary to secure the bounty may be made before any officer authorized to administer oaths. In other words this official, often unfamiliar with the animals in question, is the only person required to pass on the identity of the scalp or scalps presented; and the law provides that all scalps (evidence) be destroyed at this time. Many bounties are thus allowed through simple error and it is believed that much money is wasted in this manner.

If the bounty system must be used at all, correct identification of skins should be insured by insisting that the whole skin be presented for bounty; indeed, in doubtful cases the skull should be produced. At the time the bounty is paid the skin should not be cut in any manner which will tend to decrease its value in the fur market. Instead of cutting off the hind feet, it is a better plan to require that the bones (radius and ulna) of the right fore leg be left attached to the skin, in order to bring the bounty. These leg bones are detached

when the bounty is paid. This system would protect all counties against paying two bounties on the same skin, and it would leave the skin intact.

Fig. 7.—Map showing bounties on coyotes offered by counties in California, December 1, 1919. Counties which pay bounties are shaded. Figures indicate amount in dollars of bounty paid per coyote. Note wide range of bounty: \$1.00 in Mono County to \$20.00 in Sonoma County.

The bounty system is, at best, well-nigh futile; this is well illustrated by the coyote act of our own state, which went into effect March 31, 1891, and was suspended September 30, 1892, after \$187,485² had been expended and little had been accomplished. It

² T. S. Palmer, Yearbook U. S. Dept. Agric. for 1896, p. 60.

is the opinion of those who have made a study of this question that the bounty system is not only vastly expensive and productive of endless fraud, but that in no known case has it given any general or permanent relief.

CO-OPERATIVE COYOTE CAMPAIGNS

Two of the more progressive counties of the state, both vitally concerned with the coyote problem, are now carrying on *coöperative* coyote control work with the Federal Government through the Biological Survey, which agency is also carrying on predatory animal control work in seven other counties of the state. It is the author's belief that the *coöperative* method is much superior to the bounty system. In support of this opinion, it may be stated that the *coöperative* method of handling the coyote problem has been recently thoroughly tried out in Nevada. According to the biennial report of the State Rabies Commission of Nevada for 1917-1918 this method has been found to be much superior to the bounty system. Under this plan the work is carried on upon a 50-50 basis. A competent inspector of the Biological Survey has charge of all trappers in a given district. The trappers are chosen from among the best coyote trappers in the state and are paid a regular salary which varies according to experience, success and equipment. They are not allowed to accept bounties from any source and must turn in, properly prepared, all skins taken by them. The pelts thus obtained are sold at public auction and the money divided between the general fund of the county and that of the United States Treasury, respectively. The trappers are required to account for a reasonable number of predatory animals each month and to trap where coyotes are known to be doing the most damage. In many instances the fur practically pays the trappers' wages.

PREPARATION AND CARE OF COYOTE PELTS

To be of greatest value in the fur market coyote pelts should be prime (taken between December 1 and February 15) and prepared as follows:

1. The skin should be eased, not flat; that is, in skinning, the opening cut should be made from the sole of the foot, down the back of each hind leg to the base of the tail; also the tail should be split its whole length and the bone removed.

2. All dirt, grease, cockle burs, blood clots and other foreign substances should be washed or combed out of the fur.

3. All pelts should be thoroughly fleshed; that is, all fat and adhering pieces of meat scraped from the flesh side of the skin.

4. Each ear should be skinned out so as to turn inside out clear to the tip, in order to prevent "slipping" of the hair on the ears. The cartilage should preferably be left in, attached at the rim.

5. The pelt should be dried, flesh side out, on a stretching board, in an airy, shady place. Before it becomes entirely dry it should be turned fur side out and thenceforth kept that way.

6. If coyote pelts are to be kept for several months they should not be left hanging over a beam in a shed or building to be ruined by moths and dermestids. They should be fumigated by placing them in a tight box together with a saucer nearly full of carbon-bisulphide. Care should be taken to keep all exposed lights away from the explosive carbon-bisulphide fumes. The pelts will then be safe from insect pests for months if left in the box.

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